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Nationalisation of the Iron and Steel Industries

A ".large measure of control," was the phrase used by Mr. Wilmot, Minister of Supply, when he first intimated officially that the Government intended to make a State monopoly of the iron, steel and ironfoundry industries. Now this has been qualified by the announcement that the State monopoly is to include iron ore, pig-iron manufacture, steel ingot making, heavy rolling mills and foundries making spun cast-iron pipe, and the like. The rest of the industry is to be examined " section by section and firm by firm, in consultation with the industry, before deciding on the exact boundary in each case." Continuing, the Minister said, " Then there are the ironfoundries manufacturing iron castings. A large part of this industry was closely associated with engineering and should be left to private ownership, as should the many small jobbing foundries with mainly local connections. On the other hand, the spun pipe foundries were invariably associated with blast furnaces and would therefore come with them into public ownership." To those who really know these complex industries these statements are as clear as mud. From some aspects it would appear that vertical trusts are specially suited for nationalisation, but not the horizontal variety. This, however, seems to break down by taking the case of the nearest blast furnace to London. As this is integrated with the manufacture of motor vehicles, and so far there has been no threat to make a State monopoly of this industry, it must, to be logical, constitute a lopping off of a very important section of this concern. Presumably the only future benefit this firm can derive for their enterprise will be the proximity of supply. Then the manufacturers of spun pipes are Stanton, Staveley, Clay Cross, Cochrane's, and one other scheduled, which does not propose to erect a blast furnace. Stanton also makes concrete pipes, whilst the Staveley concern enters the chemical industry, it even makes dyes for the kipper trade! Newton Chambers have collieries, blast furnaces, extensive ironfoundries, but to the man-in-the-street the concern is best known for the Izal range of disinfectants.

Beyond the " section by section " business, steel founding has not so far entered the picture, if and when it does, there are more headaches for " boundary commissions," as some are integrated with iron and steel concerns, whilst others of equal dimensions are quite separate entities. This recapitulation of what should be general knowledge, is designed to indicate that much more than the iron and steel industry will be affected. Every ironfoundry, except the purely jobbing concern must be disturbed as to the future. Efficiency is not a factor of importance, as Mr. Morrison informed a Canadian audience that the iron and steel industry was inefficient and therefore needed to be a State monopoly for the good of the country. Other Government spokesmen have insisted that the industry is essentially efficient and therefore should be taken over by the State. However, *force majeure*, it must be the same people—the actual doers—who will still operate the ferrous metallurgical industries, and they will still continue to give of their best, though true enterprise may give place to routine efficiency—a quality so much appreciated in Whitehall. On the other hand there should be much money for re-investment and providing there is drawn a recognisable boundary line between what is and what is not to be a State monopoly, increasing private enterprise in new lines should result, with consequent benefit to what is left by the Government for this purpose.

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REGULATIONS CONCERNING PRICE CONTROL

By F. J. TEBBUTT

The power taken by the Supplies and Services Act, 1945, to alter the Goods and Services (Price Control) Acts, 1939 to 1943, has now been put into operation by an Order in Council, which particular provision is really additional power to that given as regards price control by the general provisions of the 1945 Act mentioned, as now control can be exercised whether it comes within the objects of that Act or not. That Act relates to control and regulation of supplies and services essential to the well-being of the community, or their equitable distribution or their availability at fair prices, that is, it really only applied to essential goods, but this further provision means that price control can be exercised in relation to goods and services which may be considered non-essential as well as those essential to the community.

Maximum Prices

By the 1941 price control Act, "maximum prices" could be fixed, but only for *classes* of goods, the power not extending to different qualities or grades of such classes. Now, by this Order in Council, the Board of Trade can by direction, in regard to a particular business, fix "maximum prices" to be charged for goods in the course of that business, as well as by Order to apply to classes as before. The relevant provision has been altered to read that the Board may (*a*) by Order made in respect of any class of business, or (*b*) by direction given with respect of a particular business, fix maximum prices to be charged for goods of any description specified in the Order or direction as the case may be. A direction as regards a particular business will apply in front of any Order there may be as regards classes of similar goods.

The above applies to services (*e.g.*, public utility services, etc.) as to goods thus charged, as well as prices are controlled. As regards services also, whereas maximum prices could only be fixed for services in connection with goods, now this power extends to services not performed in relation to goods as well as otherwise.

Price Control Marks

A new section now provides for "price control marks" to be applied to, or used in connection with, goods specified in the Order or direction as the case may be, and such a mark may just show that the goods are price controlled or the actual "maximum price" stated, in which case that price will apply and not the price in the Order or direction.

Another provision shows that customers must be given particulars of the "maximum price" (or charge), and furthermore, persons selling wholesale are required to give particulars of the "maximum retail price" applicable to such goods.

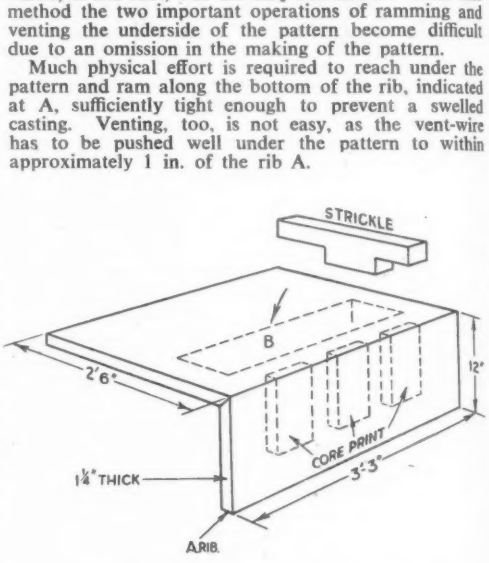
THE ADDRESS OF the Birmingham office of the British Thomson-Houston Company, Limited, is now 8, John Bright Street.

SIMPLIFYING A PATTERN FOR BEDDING-IN

By W. G.

The pattern of a furnace fitting shown below could be moulded with much less difficulty by turning it over in a two-part box than by bedding it in the floor, which, in this case, was the only alternative. With this method the two important operations of ramming and venting the underside of the pattern become difficult due to an omission in the making of the pattern.

Much physical effort is required to reach under the pattern and ram along the bottom of the rib, indicated at A, sufficiently tight enough to prevent a swelled casting. Venting, too, is not easy, as the vent-wire has to be pushed well under the pattern to within approximately 1 in. of the rib A.



To make comparatively easy the operations of ramming and venting all that is necessary is to cut an opening in the pattern indicated by the dotted outline B, and which in this case was omitted, so that the moulder will be able to ram straight down to the bottom of the pattern with the necessary force behind his rammer and at the same time noting the results after each course of ramimng. Most of the venting can be performed through the opening much easier and with satisfaction.

Before withdrawing the pattern the opening is strickled out to correct thickness and by watching the progress of withdrawal through the opening the pattern can be more steadily released with a minimum of sand disturbance round the core-prints.

A COMMITTEE OF SCIENTISTS, with Sir Henry Dale as chairman, has been appointed to advise Mr. Hynd, Minister responsible for the British zone in Germany, on questions relating to German scientific developments.

A NOTE ON THE SOURCES OF HYDROGEN IN CAST IRON

It is shown that to avoid excessive hydrogen in cast iron, the moisture content of coke should be controlled at 2 per cent. maximum

By R. C. TUCKER, M.A.

The following investigation, while being far from complete, is presented because it is thought that a number of day to day "inexplicable" variations in cupola-melted cast iron may be found in some measure due to variations in hydrogen picked up. This has been recently noticed by Dr. J. E. Hurst in the case of acid-resisting cast iron where wet ladles and pig-irons were investigated.

The investigation really started in 1944 when certain porous defects were encountered in centrifugal liners. These became very troublesome, and their source could not be traced. The Author suspected them to be the residue of a gaseous eruption in the solidifying metal set off by some "trigger" action such as a porous mould-entrained mould dressing, etc., and hydrogen was considered as a distinct possibility, from micro-examination of such defects.

Variations in the moisture content of the blast were measured hourly, but no connection with the occurrence of the eruptive defects could be traced. It was noticed, however, that when a *new*, intermediate, metal container was in use between the cupola and hand ladles, the defects were very prevalent for the first day or so of use. This was, of course, slight evidence in favour of the "hydrogen" theory, and in line with Hurst's findings when these were published.

In the meanwhile, the consideration of the "gas eruption" theory gave rise to the idea that, if the analysis of the molten metal through which the gas had to burst were adjusted to certain conditions, the metal might be still fluid enough to settle back into a solid coherent structure under the centrifugal force. If the metal is of eutectic composition, the advancing wall of solidified metal is sharp and the transition from solid to liquid metal is rapid. Under such conditions the gas evolved on solidification might escape freely through the liquid metal. At a composition widely differing from eutectic, *i.e.*, very low total carbon, the primary crystals are so different in composition from the eutectic that they deposit at a high temperature, and gas bubbles form at these nuclei and can escape through the liquid residue, which is large compared with the primary crystals, and so the gas is practically unobstructed.

At some intermediate range, the primary crystals might be sufficient to entrap the gas bubbles for a short time—thus, when the gas does burst through, it is through "pasty" and not "fluid" metal, and it "explodes" at the surface with the disturbance noticed. In support of this, it was noted that when the solidification range (liquidus—solidus interval) was measured by means of the Quick Immersion Schofield-Grace Pyrometer* the eruptive defects were most prevalent when the carbon silicon figures were such that the solidification range was 20 to 25 deg. C. Below 10 deg. C. range, and above 50 deg. C. range, the prevalence was considerably reduced; but certainly not cured. This is illustrated in Fig. 1.

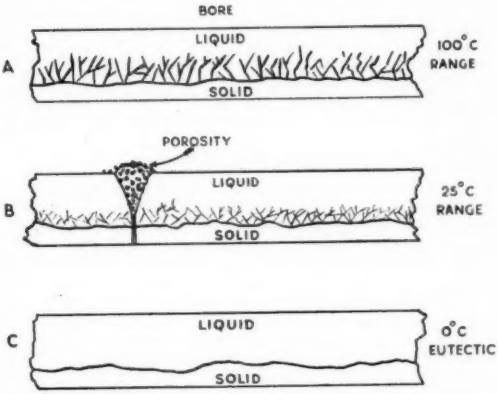


FIG. 1.—POSSIBLE MECHANISM OF POROSITY INCIDENCE IN CENTRIFUGAL CASTINGS.

Potential Sources of Hydrogen

A month's run at eutectic composition showed good improvement in scrap, but the continued hunt for hydrogen sources had, by now, abandoned the blast moisture, and was concentrated on refractories and coke moisture contents. Refractories were baked well over this period, and could be considered as constant and low a source of moisture (hydrogen) as could be easily and practically achieved.

The survey of the first month's results showed the surprising but encouraging result that, if the coke moisture were less than 2 per cent. the "eruptions" were very rare, and above 2½ per cent. they became obvious. This period was followed by deliberate relaxation of the carbon control in the metal, to give periods where the solidification range was in the dangerous 20 to 25 deg. C. zone. Variations of coke moisture and daily solidification range determinations were taken, and, while the solidification range was shown still to have an effect on the prevalence of "eruptions" the influence of coke moisture was much more profound. Thus, if the solidification range was 20 to 25 deg. C.

*"The Immersion Thermocouple in the Grey Iron Foundry," by R. C. Tucker, FOUNDRY TRADE JOURNAL, April 26, 1945.

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the influence of the moisture was such that up to 1 per cent. moisture, no eruptions occurred, and above 2 per cent. moisture as many as up to 50 to 60 per cent. of the long thin liner castings were scrapped owing to "eruptions." It was noted that castings chilled due to a cold die (very rapid solidification rate) showed many external "pinholes" but no "eruptions."

All this time it was difficult to control coke moisture, but as soon as it became apparent that it was an important influence, it was arranged to have the coke sent in sheeted wagons, and an attempt was made to work the large coke storage shed so that coke was used only after drying out for several weeks. This took some time, but gradually the management could rely on the men to work the coke shed so that coke moisture ran consistently under 2 per cent. The use of sheeted wagons also proved that moisture was largely introduced during quenching at the ovens, and not due in any great degree to the weather during transit, except where prolonged storage in the open had been the case.

Eruption Trouble Mastered

During the next six months, the eruptions were so rare that their occurrence in three or four castings was sufficient to cause the operators and chargehands to make contact with the metallurgical staff within a few minutes. In every case thus examined the procedure was to analyse one of the faulty castings; carry out a "solidification range" test on the liner metal, and analyse a block from the same ladle, and so check up on the metal composition which could be correlated with the solidification range by experience over many checks. At the same time the coke being used in the cupolas was sampled again and tested for moisture. Invariably it was found that the coke usage system had broken down owing either to carelessness or absence of the usual man, and coke straight from the truck, or which had been in store only a few days, had been used, and the moisture content was over 2 per cent. Sometimes just one skip of coke had been thus used, but as this was invariably discovered, the practice ceased, and trouble from eruptions practically ceased also.

In the absence of apparatus for vacuum fusion or extraction it was not considered practicable to proceed further with the investigation, and check up on the hydrogen content of cold castings containing eruptions, and others free from them, or even to test the metallic raw materials.

Hydrogen Determination

It was, however, deemed of interest to try and determine the hydrogen (and other gases) evolved from a sample of molten cupola metal, as the measurement of the "residual" hydrogen was relatively easy, and could be undertaken later. The sum of the two should approximate the total hydrogen content of the metal.

In 1943, Hatfield and Newell, in the J.I.S.I., published a short Paper on the determination of the hydrogen in liquid steel. Previously, W. Y. Buchanan's "Cast Iron Bell Method"* had been tried by the Author, and found to be quite inadequate to deal with this problem, as, when the apparatus was free from leaks, the

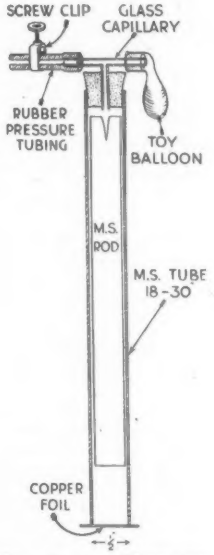

FIG. 2. — NITROGEN-FILLED SAMPLING TUBE.

amount of gas collected from 50 lb. of molten metal was only of the order of 20 ml., and thus was lost in the dilution with air originally in the bell and connecting tubes.

The method of Hatfield and Newell is much more delicate, and is described in the original Paper; but a few comments on the practical side may not come amiss. The sampling tube consists of a heavy walled mild-steel tube of internal diameter about 0.5 in. and 2 ft. 6 in. length. This is carefully cleaned inside and out, and across the bottom should be dry soldered a disc of thin copper foil (obtained from chemical laboratory suppliers for standard copper solutions). This electrolytic copper is preferably de-gassed by heating at 400 deg. C. for a few hours. The Author found dry soldering inconvenient, and used spirits of salt flux. Immediately after soldering the tube was boiled out with distilled water, then a few seconds with hot 5 per cent. sulphuric acid and finally with distilled water several times, and dried by hot air blast. The whole was baked at 150 deg. C. until 30 min. before use.

Down the inside of the steel tube is passed a steel rod which is a loose fit and kept in position by wedging

* FOUNDRY TRADE JOURNAL, December 28, 1939.

open a hacksaw cut in the top end. This rod is of such a length that 1½ to 2 in. of the bottom of the steel tube is empty, and about ½ to ¾ in. at the top also. Its function is to reduce the "dead space" in the tube. The bottom space is subsequently nearly filled by the molten sample, and into the top space is inserted a glass capillary T-piece in a short length of rubber pressure tubing, which makes a gas-tight joint with the steel tube.

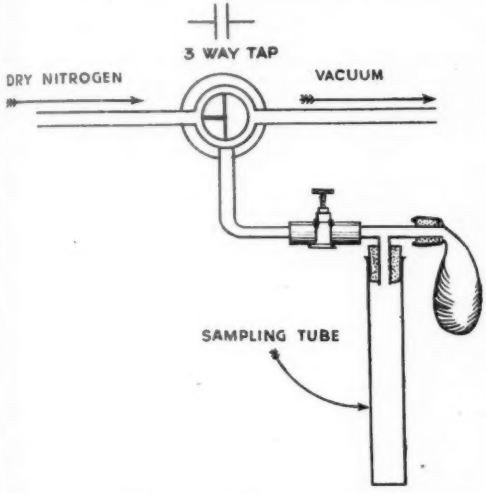

FIG. 3.—FILLING SAMPLING TUBE WITH DRY NITROGEN.

One side arm of the T-piece is connected to a toy balloon, which ensures atmospheric pressure at the time of sampling and evolution, and the other to another length of pressure tubing with a screw clip. The apparatus is shown in Fig. 2.

This sampling tube is filled with dry nitrogen by evacuating and passing in dry nitrogen either from a cylinder, an aspirator filled with nitrogen (made from the thermal decomposition of ammonium dichromate), or, as recommended by Hatfield and Newell, by the removal of oxygen and carbon dioxide from air. The last mentioned is, perhaps, the more portable form, but the chemicals need frequent re-charging (Fig. 3). The Author, however, used an old Orsat apparatus, and removed oxygen and carbon dioxide by alkaline pyrogallol. Two portable Orsat bulbs of about 100 ml. capacity each sufficed, with care, to charge three sampling tubes for the triplicate and duplicate estimations used to test the method. It was found advisable to clean and charge the tubes within an hour of taking the sample.

The charged sampling tubes, held in one hand, and separated by about ¼ in. were warmed at the lower end, and the sample of the molten metal was taken in a pre-heated sillimanite hemispherical sampling scoop. The tubes were immersed to a depth of about 1½ in. in the molten sample, and, as soon as the metal began to form a crust, they were *slowly* raised until only ¼ in. immersed. As soon as the crust was thick and "pasty," the tubes were removed by rocking and pulled out. When this procedure was followed, it almost invariably happened that a solid gas-tight plug of cast iron about 1¼ in. long occupied the lower ends of the tubes, and so the gas evolved from the metal must have gone into the nitrogen in the sampling tube. The upper surface of the sample was hemispherical, smooth and bright.

The contents of the tube occupied 20 to 25 ml. at N.T.P. The side arm with the screw clip was attached to a gas analysis apparatus (preferably of the Ambler type, but home-made for this particular series of tests) and the gas extracted as completely as possible by raising and lowering the mercury reservoir of the gas analysis apparatus. In order to prevent contamination with air, in case the sample plug were not completely gas-tight, the lower end of the sampling tube was plunged into a beaker of water as soon as it became black and kept there until the gas had been extracted. Any leak would lead to displacement of the gas by water, and this appears from Hatfield and Newell's Paper to be the rule with steel, and was found to be the case with a 40 per cent. nickel bronze which was tested as a matter of interest during these experiments.

Gas Analysis Apparatus

The gas analysis apparatus was home-made owing to the difficulty of getting quick delivery of suitable apparatus during 1945. The Author is not a particularly skilled glass worker, and as the apparatus only cost the Author's (spare) time, and less than thirty shillings, a description of it may interest those small foundries where expenditure of money on expensive apparatus of doubtful regular use is not easily allowed.

The mercury from an old barometer, sundry lengths of glass tubing (some from scrap burettes), 3 ft. of rubber pressure tubing and a few short lengths of fused silica sheath and insulator tube from the immersion pyrometer stock, were combined to form the main body of the apparatus (Fig. 2). A wooden metre rule and two three-way glass stop cocks were also available but can now be purchased quickly.

A diagram of the apparatus is shown in Fig. 4, from which it can be seen that it follows the usual Orsat principle except that the different re-agent pipettes are attached at C as required while the gas sample is in the reservoir. The oxygen is estimated by means of pyrogallol, the CO_2 by caustic potash, etc.

The sample residue, or an aliquot, is mixed with a measured volume of air or oxygen and combustion by leading through a fused silica tube containing palladinised asbestos. The use of fused silica was found advisable in order that all the gases could be quickly displaced from the furnace by water after the combustion ends. The construction of the furnace is shown by

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Fig. 5 to be very simple. It consists of about 6 in. of fused silica tube as used for the sheaths of Schofield-

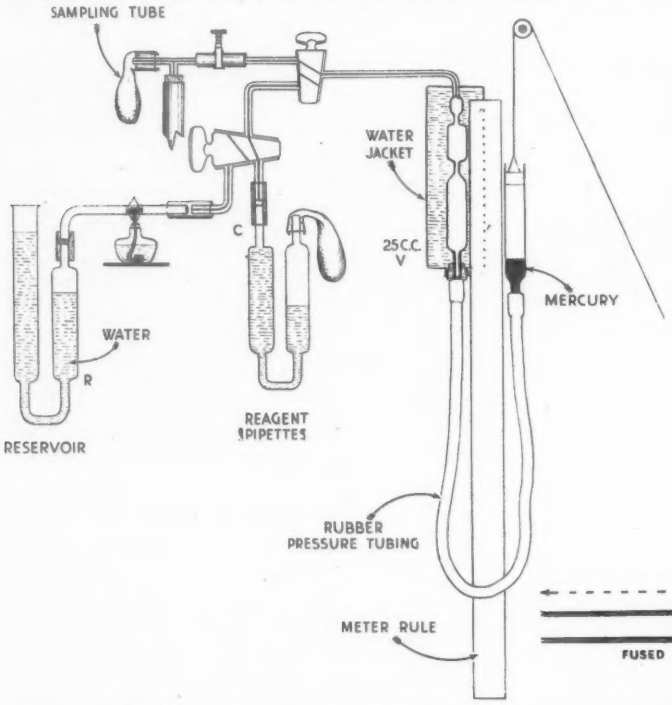


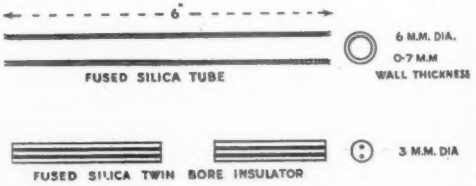
FIG. 4.—HOME-MADE GAS ANALYSIS APPARATUS.

Grace immersion pyrometer. A length of twin bore fused silica insulator from the same source was inserted so that one end of each coincided and the fused insulators reached to about half-way along the sheath. Using a small oxyacetylene welding flame, the sheath and insulator together were bent through a right angle. This holds the insulator in position and reduces the "dead space" considerably. A small loose plug of palladinised asbestos is inserted in the open end of the sheath, and passed nearly up to the end of the insulator. A further length of insulator is cut off and inserted into the open end of the silica sheath and held in position by sealing wax.

The plug of palladinised asbestos is thus held in position by the fused silica insulators. During the combustion, the asbestos is heated by a methylated spirit flame and the silica is sufficiently translucent to see the dark plug of asbestos and observe the combustion glow during the first pass of the mixed gas and air.

After the combustion (2 to 4 passes) the gas can be sucked straight back into the measuring burette, and displaced by water without cracking any glass, and without loss or uncertainty of measurement. All readings can be taken at a certain volume mark on the measuring burette, and the pressure difference to bring the mercury meniscus to this mark is measured on the metre scale, which can be read to 0.5 mm. This simple apparatus will determine 0.5 ml. H_2 in 15 ml. of a hydrogen: nitrogen mixture with an accuracy of $\pm$ 0.03 ml.

The sampling tube is removed as soon as it has been emptied as far as possible of gas (95 per cent. extraction is easily possible). The T-piece separated from the steel tube and about three inches of the bottom end removed by a hack-saw. Measure the length of the solid plug, and observe its top surface. Now machine a $\frac{1}{2}$-in. by $\frac{1}{2}$-in. dia. test piece from the cast iron (machining off the mild steel case) and this test piece is now suitable for vacuum fusion or extraction to determine residual hydrogen. Note that the masses of the "evolved" hydrogen test piece and vacuum fused end piece



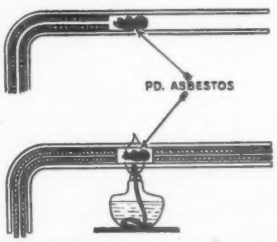


FIG. 5.—DEVELOPMENT OF FUSED SILICA GAS COMBUSTION FURNACE.

THE NEW FOUNDRY OF E. GREEN & SON, LIMITED

Last Friday, Mr. E. Shinwell, Minister of Fuel and Power, opened, at the works of E. Green & Son, Limited, Economiser Works, Wakefield, a mechanised foundry for the production of small iron castings required in the manufacture of fuel economisers. Melting is carried out in 5 tons per hour cupolas supplied by George Green & Company, Limited, of Keighley. They are charged mechanically by skip hoists.

The sand plant consists of a 30-ton capacity-treated sand storage bunker, with twin outlet shoots having control doors feeding a skip hoist with a 20-cwt. capacity skip. The hoist is electrically controlled and is semi-automatic; when started raises the skip to a point of discharge to an 8 ft. outside diameter "Smedley" sand mill, and returns to rest at the filling position, which is a place at which new sand can be put into the system.

Sand discharged from the mill is aerated and delivered to a belt conveyor for distribution to hopper shoots supplying moulding machines, each point serviced by gravity runways to a casting conveyor shown in Fig. 1. After filling the moulding machine hoppers by means of V-ploughs, any excess sand drops down a shute, shown in Fig. 3, on to the spillage conveyor, to be taken back for reconditioning. This conveyor runs underground in the front of the moulding machines and permits of the sand spilt during production to fall through gratings located directly over the belt.

FIG. 1.—SHOWING MOULDING MACHINES; FEEDING HOPPERS AND ROLLER PATHWAYS.

FIG. 4.—SAND PREPARATION PLANT; DUST EXTRACTOR AND CYCLONE.

The moulding machines serving the system are two A.T.4 type roll-overs and two H.P.L.I. by the British Moulding Machine Company, Limited.

The casting conveyor is the pallet type extending round the whole bay, and in Fig. 2 is illustrated the metal pouring station, where the ladles of molten metal are carried between the two cupolas by suspension blocks on an overhead runway, the pouring occurring under a hood connected to an extraction plant to take away the fumes to atmosphere. The moulding boxes with castings then pass through a cooling chamber, which is also linked up with the extraction plant to further deal with hot air and fumes. The casting conveyor has a speed variation between 3 ft. and 12 ft. per min., driven by a 10 h.p. motor, through worm reduction gearbox, variable speed

gear and a creeper chain drive, all positioned below floor level.

In Fig. 3 the cooling tunnel is seen on the left, and as the moulding boxes complete the cycle they are

FIG. 2.—THE TAPPING SIDE OF THE CUPOLAS, CASTING STATION WITH FRAME COLLECTING HOOD AND MONO-RAIL FOR LADLES.

pushed off the casting conveyor by a compressed air-operated "pusher" over a gravity roller conveyor to the vibrating "knock-out," seen in the foreground of Fig. 3, where the sand passes into a shoot below, the castings taken away to the fettling shops, and the empty

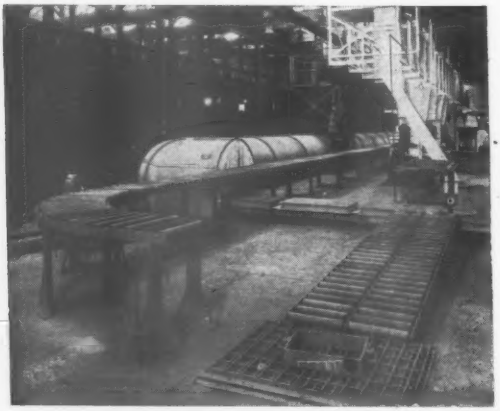


FIG. 3.—GENERAL VIEW OF THE PLANT SHOWING KNOCK-OUT GRID IN FOREGROUND, COOLING TUNNEL, AND IN THE DISTANCE THE MOULDING PLANT.

boxes returned by gravity roller conveyor to the moulding machines.

Spent, knocked-out sand is carried underground on a belt conveyor, the belt being of heat-resisting rubber, and *en route* tramp metal is extracted by overband magnetic separator by Electro-Magnets, Limited, of Birmingham, to the sand preparation plant, where it is elevated and screened by means of a $\frac{1}{16}$ in. mesh rotary screen, and afterwards cooled by the "Colhep"* method, and bunkered for re-use. This plant is illustrated in Fig. 4, and being novel will be the subject of a separate article in the near future. The bucket elevator operates at 190 ft. per min. It uses 8 in. wide pressed steel buckets.

At all points where sand is transferred from one unit to another, and where dust is likely to accrue, dust collection points have been incorporated into the main air system. The sand plant and much of the mechanisation scheme has been carried through by the Hepburn Conveyor Company, Limited.

STANDARD CATALOGUE SIZE

The trade and technical literature issued by manufacturers is in such a multiplicity of sizes and shapes that the recipient has considerable difficulty in filing the documents, with the result that much of his literature is either thrown away, or is stored unused. This represents a waste of effort on the part of the firm issuing the literature, and although many manufacturers deliberately endeavour to make their literature of a special size or shape to make it distinctive, this has its drawbacks which are probably not counterbalanced by its advantages.

It is therefore of interest to note that the British Standards Institution has recently issued recommendations on the standardisation of the sizes of manufacturers' trade and technical literature. These recommendations have been drawn up primarily in relation to the literature issued by the building and allied industries, but many of the points brought out in British Standard 1311-1946 are applicable also to other industries. The recommendations deal with the page sizes, and some observations are also made regarding the thickness, weight, and titling of catalogues. A further section makes recommendations regarding the arrangement of the contents of the publications. It is suggested that the technical and commercial data should be arranged in a definite standard order so that once architects and builders have become accustomed to the arrangement they will know where to find any item quickly. It is recommended that the contents be set out under eight main headings, and although all these headings may not be applicable to any particular product, those items which are applicable should be arranged in the sequence specified.

Copies of this British Standard may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 1s.

*Patent No. 558808 .

THE FORMATION OF BANDED STRUCTURES IN HORIZONTAL CENTRIFUGAL CASTINGS*

CONTRIBUTION TO THE DISCUSSION

Dr. L. Northcott, Dr. O. R. J. Lee and Mr. D. McLean write that they find themselves in some difficulty in discussing Mr. Howson's Paper, since there is so much in the Paper with which they disagree. Some of the statements are so palpably incorrect scientifically and so contradictory to the extensive experimental work on the subject carried out in the Armament Research Department that they consider that it would be regrettable for the Paper to remain unchallenged. It would clearly be undesirable to give a detailed discussion of all the items in the Paper with which they disagree, but they are glad to have the opportunity of commenting on some of the more important points, dealing with the experimental work first and the theory later.

Fig. 5 and Table I of the Paper refer to a gunmetal casting, "selected . . . as offering the most extreme degree of separation," and the conclusion is drawn that "no counterpart of the banded structure . . . is apparent, and this may be regarded as typical of . . . the bronze type." Personal experience is that segregation banding is easily produced in such alloys, and Fig. 23 of Reference 1 shows a pronounced banded structure in bronze.

It is the contributors' experience that pronounced banding can be developed in bronzes, phosphor-bronze, grey cast iron, white cast iron, and a wide range of aluminium-base alloys when cast by the centrifugal process under suitable conditions, and they would not agree with Mr. Howson that these alloys are free from banding. On theoretical considerations of solidification it would be expected that the only material quite free from segregation banding would be a pure metal, and that an increase in the degree of banding would be brought about by an increase in the freezing range of the alloy and by a reduction in the rate of diffusion of any alloying constituents.

Temperature Readings Criticised

The use of an optical pyrometer for the measurement of under-cooling in the solidification of metals is surprising; even more surprising is the claim that the curve shown in Fig. 9 indicates under-cooling. When a liquid metal is cooled there is a steady fall in temperature to some minimum value (indicating a state of under-cooling), after which there is an immediate rise in temperature. In other words, a horizontal on the cooling curve *must* represent the progress of solidification. Whatever else it shows, Mr. Howson's curve comprising a horizontal portion over a time interval of 5 or 6 mins. does not, as he claims, show under-cooling spread over such a period of time. A more likely explanation for the curve in Fig. 9 is that black body conditions were not present during the optical pyrometer readings, and that the horizontal part of the curve shows the freezing point, the later peak being due to an increase in emissivity of the solid metal surface as compared with the liquid. When sighting the pyrometer through a comparatively small pouring hole, the ends of the mould would be at a comparatively low temperature, and absorb much of the radiant heat from the inside of the cast cylinder. It is only when all parts of an enclosure are at a constant temperature that black body conditions are obtained in that enclosure. In addition, is Mr. Howson satisfied that the presence of flame or fumes in the mould has not seriously affected the readings of the optical pyrometer?

Fig. 1 of the Paper does not show the correct relationships between diameter, speed and "times gravity." The formula for this is

$$\text{"times gravity"} = 0.000{,}014{,}19\ DN^2$$

From this it is evident that times gravity is proportional to the square of the speed, yet reading from Fig. 1, at 10 in. dia., 500 r.p.m. gives 50 G and 800 r.p.m. 80 G. Fig. 1 shows centrifugal force $\propto$ r.p.m. $\times \sqrt{\ }$ radius, whereas it should be $\propto$ (r.p.m.)^2 $\times$ radius.

Theoretical Aspects

Turning now to the theoretical aspects of the Paper, when Mr. Howson discusses Fig. 3, his mathematical argument based on a static method of treatment is not applicable to the problem under consideration, which is a dynamic one. It was with the object of proving this point that the experiments with water in a revolving tube were undertaken,[4] and they showed that the eccentricity of bore calculated by static methods similar to Mr. Howson's did not give results consistent with experiment. In the section dealing with the problem sketched in Fig. 4, the assumptions are believed to be erroneous. According to Mr. Howson, $\cos\theta = V^2/gr$. Since $\cos\theta$ mathematically must lie between 0 and 1, and V^2/gr can be made to have any value over 1, the result is clearly absurd, and similarly Mr. Howson's statement that θ is proportional to the centrifugal force is incomprehensible.

Mr. Howson's theory is based on the assumption that the liquid rotates at a low speed corresponding to only 2-4 G so that the fluctuating force of $\pm$ 1 G caused by gravity is important, the resultant force acting on a particle in the liquid thus varying between a maximum and a minimum during rotation causing the formation of one band per revolution. In the contributors' view this conclusion is contrary to their experimental work on the subject. It is to be expected that a continuous frictional force acts on the liquid allowing considerable drop in the velocity of the liquid as the bore layers are approached, fluid slip being a minimum at the liquid-solid interface. An example may be quoted of a casting poured at a mould speed corresponding to 40 G which was suddenly braked to

* Paper by Mr. H. O. Howson read before the Sheffield branch of the Institute of British Foundrymen, and published in the February 21 issue of the JOURNAL.

The Formation of Banded Structures

25 G; the direction of inclination of the columnar crystals showed that after braking, the liquid in contact with the solid was overtaking the mould. As solidification proceeds radially inwards, the layer of liquid is reduced in thickness and for this reason alone the liquid at the bore gradually increases in speed until, immediately prior to its solidification, the speed in terms of r.p.m. approaches that of the mould.

This is particularly true of alloys showing a freezing range since there is a radial zone (narrowest in chill castings) adjacent to the solid wall where the temperature is between the liquidus and solidus temperatures. The zone of liquid containing solid nuclei is adjacent to the irregular solidifying surface and must revolve at a speed close to that of the mould. Thus, whilst the contributors agree with Mr. Howson that the liquid near the bore is rotating comparatively slowly in the initial stages of casting, they do not agree that solid nuclei can form in such slowly rotating liquid. Nuclei are only formed in liquid adjacent to the solid interface where high speeds are obtained.

A further argument against Mr. Howson's theory is that in all the contributors' experimental work, banding was experienced at higher mould speeds than those giving freedom from banding. Furthermore, the argument that one band forms per revolution of the liquid leads to the conclusion, stated on page 108, that in a thick casting, 1¼ in. froze in 5 secs., yet no freezing time under about 2 mins. fits the cooling curve shown in Fig. 9, and they would interpret the curve as showing solidification to have taken about 5 mins.

In formulating his theory, Mr. Howson has ignored the fact[1 2] that vibration of unrotated ingots cast on a chill base can give rise to banding segregation of exactly the same type as in centrifugal castings and that application of out of balance weights to a centrifugal casting machine will produce banding which was not evident under the same conditions without the out-of-balance weights.

The Armament Research Department Theory

The essence of the theory of banding put forward by the Armament Research Department investigators is that in the presence of a steep temperature gradient from the chill mould, a segregate of lower melting point liquid is able to build up in front of the advancing wall of solid until some liquid away from the solid-liquid interface, by virtue of composition, actually under-cools a little whilst the impure liquid in contact with the solid interface has not reached its freezing point. Vibration operates by releasing this under-cooling and enables the separation of solid nuclei of purer solid metal to occur away from the main solidification front. This explanation not only covers the segregation observed but also the porosity associated with exceptionally pronounced banding.

Of the seven conclusions in Mr. Howson's Paper the writers can only agree with Nos. 1 and 6. In addition to the comments made above, they consider that micro-banding of the periodic type can, and frequently is, found in the columnar zone, and instances have been reported in the literature.[2 5]. Finally, they beg to draw his attention to the correct references[1 2 3] given below to the published work on the subject of centrifugal casting carried out by the Armament Research Department.

AUTHOR'S REPLY

The difficulty of the contributors in discussing the Paper is appreciated, particularly as the views expressed are in direct opposition to the theory in which vibration is considered to be the source of micro-banding. The various points will be dealt with in rotation, but as a preliminary it must be stated that no attempt has been made to attack the primary conclusions of the Paper, that is—the origin of banded structures in centrifugal castings is the process of centrifugal separation. This theory is completely irreconcilable with the vibration hypothesis, and the relative merits of the rival viewpoint can only be decided by further experimental work.

It may not be out of place, however, to attempt a brief survey which may demonstrate that the theory of centrifugal separation is not entirely unworthy of consideration. The Author has given serious thought to the vibration theory for a long period, and has always acknowledged the value of the work carried out by the Armament Research investigators. At an early stage, however, he was forced to the conclusion that the vibration theory would not explain the structural formations encountered in commercial practice. The operation of centrifugal separation is widely employed in science (particularly biology), and appeared to offer a simple explanation to these macrostructural conditions. A close examination of castings prepared from different types of alloys indicated that there were strong grounds for the acceptance of this idea.

Short Length Tests

It is considered unfortunate that published research by A.R.D. has been confined to the examination of cylinders of small diameter (below 9 in.), in which the bands tend to annular form. If cylinders of diameters between 18 and 36 in. are examined an entirely different state of affairs exists, as the bands are in no degree annular, but consist of a series of curves interlacing into a regular pattern. The arrangement of the bands bears a simple relationship to the dimensions of the casting. The Author is of the opinion that the contributions will be the first to agree that the vibration theory is only acceptable if the bands are completely annular, and he would be pleased if the A.R.D. will consider the examination of a series of castings of varying diameter.

A further objection to the vibration theory is connected with definite experiments carried out to assess the effect of vibration on macro-strucure. In a well-balanced machine of suitable size it is possible for a machine to rotate through the casting period with a degree of eccentricity of less than 0.005 in. If the speed is such as to develop a centrifugal force in excess of 70 G, and steel is introduced, then the resultant casting will invariably exhibit a high degree of micro-

banding (Type III). Alternatively, if metal is splashed on to the end plates it is possible for the machine to become out of balance, with an amplitude of vibration which may be estimated as being 1 in. On etching a steel casting prepared under these conditions, the Author has found absolutely no difference in macro-structure.

It is regretted that there should be such a complete difference to the work of the contributors, but the Author believes that the majority of the commercial manufacturers share his viewpoint. Undoubtedly further work on machines vibrating with definite amplitudes must be performed by Dr. Northcott and his colleagues before the vibration theory may be accepted.

In considering the resumé of the vibration theory introduced into the contribution, the Author feels strongly that any segregate or metallic constituent forming in advance of the main liquid-solid front would be immediately impelled outwardly, due to centrifugal action.

The Case of Aluminium-Bronze

The contributors state that in centrifugal castings porosity is invariably associated with micro-banding. The refutation of this statement is considered most desirable as some retardation of the further progress of the centrifugal process may be caused. An instance can be given of 18,000 components prepared from aluminium-bronze in which intense micro-banding was present. After a searching scrutiny for defects less than 200 were rejected, and these rejections were largely due to the presence of inclusions. Many other examples could be given of series of centrifugal castings which have given consistently good mechanical tests, and of the exhaustive investigations which determined finally that satisfactory physical properties could be obtained from highly banded zones in centrifugal castings, if prepared under suitable conditions.

In dealing with the individual points raised by the contributors, the first objection raised is an entire misconstruction of the text of the Paper. The section deals with the segregation effects produced in gun-metals, and illustrates by a series of analyses the degree of segregation which may occur in alloys possessing a wide freezing range. Specific mention is made of the presence of bands in these alloys, but the statement is made that these are rare and ill-defined, and that no counterpart of the pronounced micro-banding is observed. This viewpoint has been substantiated by the careful examination and comparison of some hundreds of castings. The example referred to by the contributors can not be considered a definite case of Type III banding in the opinion of the writer, and certainly in the larger diameter bronze castings the interlacing pattern typical of micro-banding is entirely absent.

Temperature Determinations

The contributors show some surprise at the use of the optical pyrometer in various experiments. The Author believes that a person introducing a thermo-couple type pyrometer into a large centrifugal machine immediately after the pouring operation would be even more surprised. The optical pyrometer was selected as the only possible means of temperature measurement available, and the results were presented with the reserve normal in liquid steel pyrometric determinations. A steel casting is extremely free from smoke or flame a few seconds after pouring, and as observations sighted on the middle of very long castings gave similar results, the interfering effect of the end plates is considered negligible. The experiment of stopping the machine at suitable times indicated that solidification has occurred at the time suggested in the Paper.

The curves shown in Fig. 1 were calculated from the formula – centrifugal force $= \frac{\omega^2 R}{g}$ which is the generally accepted mathematical relationship.

The Paper states that the particle will leave the rim when $Mg \cos \theta = \frac{MV^2}{r}$. That is as soon as the value of $\frac{V^2}{gr}$ is equal to or greater than 1, the particle will leave the rim. If a particle is placed at the vertex position of a disc rotating at such a speed that $\frac{V^2}{gr}$ exceeds 1, then the particle will be projected from the rim immediately.

The difficulties underlying a complete mathematical treatment of the behaviour of molten metals or liquids in a rotating tube have been stressed in the Paper, and it was recommended that a full experimental project embracing this subject should be undertaken. The fundamental conclusion was drawn that there was a variation in resultant force during rotation, and Dr. Northcott and his colleagues have not attempted to nullify this statement. Their view that there is a considerable drop in the velocity of the liquid towards the bore is only true if streamline conditions of flow exist. As it is probable that the flow of metals is extremely turbulent (forced vortex formation) this will not apply. The possibility of turbulent conditions in centrifugal casting has been neglected by the correspondents, as it is obvious that the existence of layers of liquid in appreciably different stages of supercooling and solidification is impossible in liquid in reasonably agitated motion.

In general the Armament Research Department investigators tend to regard micro-banded formations as showing extreme structural differences from the matrix. In actual fact these macrostructures are only discernible after very careful etching, and it is only in exceptional cases such as aluminium bronzes that any microstructural differences are observed on traversing the bands. This fact coupled with the excellent mechanical properties of the banded areas, suggests that banding is only the manifestation of a mild degree of segregation, and the assumption of any degree of solidification remote from the main solid-liquid interface is unnecessary.

(*Continued on page* 143.)

A LARGE CASTING IN NI-RESIST CORROSION-RESISTING CAST IRON

Our illustration shows a large casting, recently made by the Widnes Foundry & Engineering Company, Limited, in Ni-resist austenitic cast iron. This casting, one of the largest to be made in this country, in this type of corrosion-resisting cast iron, is part of a calandria for Lever Brothers' soap works, to be used for production of glycerine. It is indicative of the increasing interest in alloy cast irons now being shown by designers and users of chemical plant.

The casting weighs 5 tons, has an inside diameter of 6 ft. 3 in., and a diameter over the flanges of nearly 7 ft., and stands nearly 5 ft. high. Although a simple cylindrical form, the casting is complicated by the four very heavy pads, each 2 ft. 2 in. face, to hold the supporting feet. It is further complicated by the various pipe facings ranging from 3 in. to 12 in. bore.

FIG. 1.—LARGE CASTING IN NI-RESIST CORROSION-RESISTING CAST IRON.

Ni-resist austenitic cast iron was selected by the user after exhaustive tests. Serious corrosion is experienced in the plant and, before the final decision was made, test pieces of various types of cast iron were immersed in a part of the plant in contact with the corrosive medium, and were examined at regular intervals. The results of these tests proved conclusively that Ni-resist cast iron was the most suitable metal to meet the conditions involved. This type of cast iron is, of course, familiar to most of our readers and is now well established for a variety of applications in chemical engineering, in mining equipment, and in engine construction.

Composition of Casting

The casting was made to the following compositional specification: T.C., 2.7 to 3.0; Si, 1.2 to 1.5; Mn, 1.0 to 1.4; S, 0.12 per cent. max.; P, 0.30 per cent. max.; Ni, 14.5 to 16.0; Cu, 6.0 to 7.5; and Cr, 2.5 to 3.0 per cent. The actual analysis of the casting produced was as follows: T.C., 2.86; Si, 1.29; Mn, 1.48; S, 0.10; Ni, 15.54; Cu, 6.45; and Cr, 3.03 per cent.

The above figures show that even with the high alloy content specified Widnes Foundry & Engineering Company, Limited, were able to produce this large casting with a composition well within the limits specified. The outstanding characteristic of a cast iron of this type is its high degree of resistance to corrosion against many mineral and organic acids, saline solutions, etc. Under most conditions its resistance to attack is many times better than that of ordinary cast iron. This property is due to the influence of the alloys in rendering the matrix of the metal austenitic, the casting thus bearing the same relationship to ordinary cast iron as austenitic stainless steel does to mild steel.

Heat-Resisting Properties

In addition to their corrosion resistance, castings in Ni-resist cast iron are marked by superior heat-resisting properties, and are, incidentally, non-magnetic, this latter quality proving useful for identification purposes. Another feature of Ni-resist is its high rate of expansion. This property is of definite value and interest to engineers as it provides castings with expansion characteristics matching that of the light alloys.

The casting illustrated was cast under normal conditions in a modern foundry which has specialised in the production of large castings for the chemical and other industries in ordinary and alloy cast irons to any normal specification, including the austenitic Ni-resist type. Ni-resist cast iron is sponsored in this country by the Mond Nickel Company, Limited, whose technical staff have been very helpful in giving practical assistance during the initial stages of production.

SPECTROGRAPHIC ANALYSIS

A general-purpose source unit for the spectrographic analysis of metals and alloys is described in a reprint from the Bulletin of the British Non-Ferrous Metals Research Association (No. 201, March, 1946, price 2s. 6d.), by A. Walsh, M.Sc.Tech. This new source unit, Mr. Walsh claims, will provide a simple condensed spark, a low-voltage d.c. arc, or, by using a triggered low-voltage discharge, a series of intermediate excitation conditions. The latter type is said to give high sensitivity and a higher accuracy than is possible with a d.c. arc, combined with good reproducibility. Only results for non-ferrous alloys are quoted.

THE CHEMISTRY AND MECHANISM OF STEEL PICKLING*

By BRIAN N. REAVELL, B.Sc., A.C.G.I., M.I.Chem.E., A.M.I.Mech.E.†

INTRODUCTION

Steel pickling is carried out in many works for different purposes, and the subject is so large that it cannot be covered comprehensively in a short Paper, but it is hoped that consideration of the underlying principles, and a description of some successful mechanisms, will be of assistance to those concerned with steel pickling. The pickling shop in most works is badly neglected. Too often improvements are made and new equipment is added to a manufacturing process with little or no attention being given to the pickling section. If the operation of steel pickling is considered as a chemical process, and if the plant is designed on sound chemical engineering principles, there is no reason why the pickling shop should not be clean and efficient—in fact, a place where workers can carry on their job without danger and in ordinary comfort. New engineering materials have simplified the problem of the pickling plant designers, and plant can be installed in the pickling shop with the knowledge that it will continue to give good service, without the repeated breakdowns which were common in the past.

Scope of the Paper

An attempt will be made to outline the principal methods that are in operation for pickling steel and the chemistry of the reactions involved. Since, however, the success of the pickling shop depends so much on the ancillary equipment, such as the acid storage, handling, disposal of effluent, etc., consideration will be given to these matters as well.

Vitreous enamelling plants generally employ a hydrochloric acid pickle, whereas a sulphuric acid pickle is most commonly used in the working of steel strip, bar, rod, wire, plate, etc. For alloy steels and some special purposes other acids are used, such as phosphoric, hydrofluoric, mixtures of nitric, hydrochloric and chromic acids. It is hoped that a general consideration of the chemistry and mechanism of steel pickling, in which these acids are employed, will assist vitreous enamellers in the study of their own special problems.

*A Paper read before the Annual Meeting of the Institute of Vitreous Enamellers.

†The Author is managing director of Kestner Evaporation and Engineering Company, Limited.

Chemical Reactions

The true nature of the chemical reactions involved in treating oxidised steel surfaces with acids is highly complex and by no means clearly understood. Many works have been written on the subject as will be seen by reference to the bibliography (Appendix 1).

From the practical point of view, however, the essential procedure of the reactions can be understood by considering the simplest possible examples. The steel surface to be pickled has become oxidised and has developed a layer of oxides of varying composition generally referred to as scale. It is usually accepted that the scale consists of a series of layers approximating to the oxides, ferrous (FeO), ferroso-ferric (Fe_3O_4), and ferric (Fe_2O_3)—in all cases the most highly oxidised layer being on the outside. The general condition of the scale depends on the temperature of the metal exposed to the atmosphere during heating and the time of exposure at elevated temperatures. In practice this means that the heavier the mass of hot metal the longer it will remain at elevated temperatures, due to its mass heat content, and the heavier therefore the scale will become. Nevertheless, the composition of the layers will remain approximately as described above.

Whenever the metal has to be submitted to cold working methods, it is generally necessary first to remove scale, either to prevent tool wear, or to prevent the scale becoming worked into the base metal. Similarly, when metal is to receive a protective layer of a different material—as, for example, galvanising, tinning or enamelling, the scale must be removed in order to secure a proper key or adhesion to the base metal and to ensure a smooth surface of the finished work when the surface coating has been applied.

Practically all methods (apart from mechanical removal, for example, by shot-blasting) depend on the provision of an electrolyte, with which any or all of the components of the scale can react and so pass into solution, or at least become detached from the base metal. Although there are a number of more or less special purpose methods, including the electrolytic methods, and gas pickling methods the most common, are by direct immersion in mineral acids. For straight ferrous metals, sulphuric or hydrochloric acids are almost universally used, the acid being converted to the corresponding ferrous salt by reaction with the

Chemistry Steel Pickling

oxides of the scale. As the scale becomes so dissolved, and as the acid penetrates cracks in the scale, the base metal becomes exposed. Indefinite exposure of the base metal would result in some dissolution of this base metal, and pitting would almost inevitably result. However, by the addition of certain materials known as inhibitors, the base metal can be rendered passive so that the acid only attacks the scale. The action of these inhibitors demands a separate study, and will not be discussed in this Paper.

The rate of attack of the acid upon the scale depends on a number of factors, the chief of these being:—(1) Concentration of acid; (2) nature of acid, (3) temperature of acid, and (4) concentration of dissolved ferrous salt. Probably the most important is No. 3, as increasing temperature produces a marked increase in the rate of pickling. Concentration of acid is also important, for below 5 per cent. pickling rates are generally slow, whilst above 20 per cent. little advantage is obtained. The concentration of ferrous salts is also of some consequence, so, broadly speaking, increasing ferrous salt concentration slows down the rate of pickling unless this slowing down is offset by maintaining a relatively high acid concentration. However, unless some form of acid recovery is practised, a compromise has to be struck between iron and acid concentration in order to economise in acid consumption, and still maintain a reasonable pickling rate.

The pickling reaction is generally described as a chemical reaction between the acid and the constituents of the scale. This description is convenient, and it certainly enables a fairly clear picture of the chemical reactions involved to be presented. Modern opinion, however, is now practically unanimous that the precise mechanism involved is electrolytic. As long as scale remains in contact with the base metal, then in the presence of the electrolyte innumerable electrolytic cells are set up of the type Fe-Fe_2O_3, Fe-FeO-Fe_3O_4, Fe-Fe_3O_4-Fe_2O_3, etc., leading to a reduction of some of the oxides to a ferrous state, which reacts with the acid ions to form ferrous salts which pass into solution. It seems probable that most of the acid attack on the scale is directed to the intermediate layer of the scale, which consists of ferroso-ferric oxide, and finely divided iron in intimate mixture and the inner layer which is mainly ferrous oxide. The outer ferric oxide layer, which is a small proportion of the whole, is only slowly attacked, and apparently first becomes detached by the dissolution of the inner layers before it dissolves. That the attack of the acid on the scale is electrochemical is shown by the fact that contact between metallic iron and the scale in the acid greatly

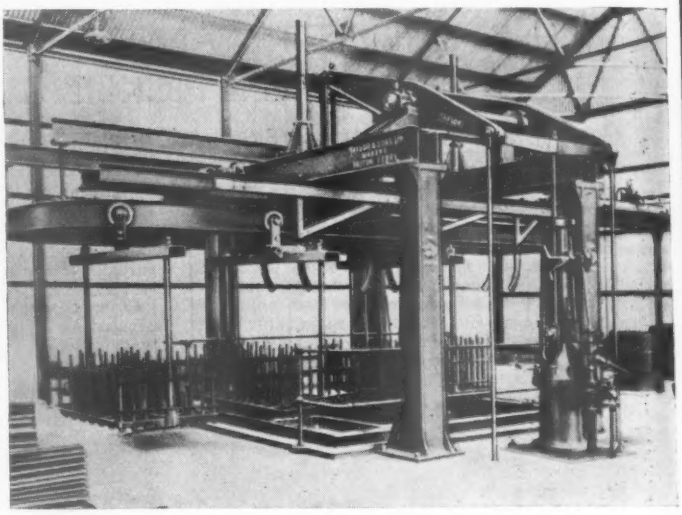


FIG. 1.—TAYLOR MACHINE FOR SHEET STEEL.

accelerates the reaction; it follows that the chemical representation of the reactions should be by means of a series of electrochemical equations. The following nett equations, however, may be taken to summarise the reactions involved:

$Fe_3O_4 + Fe + 4H_2SO_4 = 4FeSO_4 + 4H_2O.$

$Fe_3O_4 + Fe + 8HCl = 4FeCl_2 + 4H_2O.$

Intermediately, the Fe_3O_4 is probably reduced to ferrous oxide:

$Fe_3O_4 + 2H + = 3FeO + H_2O - 2e.$

then $FeO + H_2SO_4 = FeSO_4 + H_2O.$

or $FeO + 2HCl = FeCl_2 + H_2O.$

The choice of acid used for pickling is determined largely by the nature of the subsequent treatment to which the steel parts have to be put. In general, sulphuric acid is used for pickling steel prior to cold working, such as rolling, drawing, stamping, and similar applications. Hydrochloric acid is used almost exclusively for pickling prior to galvanising, tinning, or enamelling. Phosphoric acid is used to impart a protective iron phosphate surface to the steel subsequent to a normal sulphuric acid pickle and prior to painting, as, for example, for structural steelwork. Nitric acid, chromic acid, and hydrofluoric acid are used for special purposes, such as etching for crack detection

in forgings, and for descaling stainless steel. There is no doubt that sulphuric acid is the easiest to handle as well as being the cheapest. Furthermore it enables a simple acid recovery plant to be used. The resultant surface obtained by sulphuric acid pickle is not so bright as in the case of hydrochloric acid, and it is for this reason that hydrochloric acid is largely used for galvanising, tinning, or enamelling.

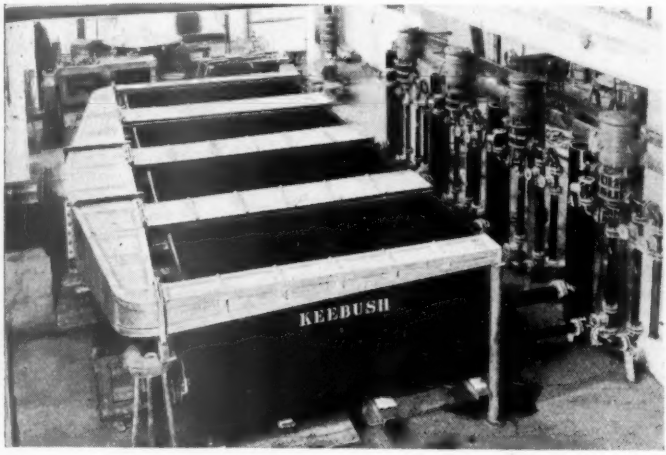


FIG. 2.—KESTNER SHORT BAR MACHINE.

Pickling Mechanisms

Plants for the pickling of steel can be divided into two general types: (*a*) batch and (*b*) continuous. Continuous pickling is to be preferred where relatively long runs of articles of similar shape have to be handled since the labour costs involved on continuous plants are considerably less than for batch plants. Batch plants, however, are essential where the pickling plant has to serve a variety of shapes and weights of steel parts.

Batch Pickling

Batch pickling is practised for steel rods, tubes, sheets, and wire in the form of coils. Also for billets, forgings, castings, stampings, pressings, and spinnings. The steel parts are lowered into the acid bath and, at the end of a given time, removed to a washing and neutralising bath. Considerable ingenuity has been displayed in the design of mechanisms to effect the charging of the steel parts into acid bath and for agitating the charge whilst it is in the bath. Owing to the enormous variation in the size of steel parts that have to be pickled, many different mechanisms for charging and agitating the steel parts are to be found in modern plants.

An example of a modern mechanised batch plant for pickling steel sheet is shown on Fig. 1. The sheets are loaded into racks suspended from an overhead conveyor, which carries the racks over the pickling tank. Steam or hydraulic mechanism then lowers the racks into the pickle tank, and at predetermined intervals raises and lowers the racks, causing thorough agitation. After pickling and washing the sheets are unloaded and the cycle repeated. All movement of the loaded racks is entirely automatic. A similar type of machine is used for pickling strip in the coil form.

Fig. 2 illustrates a batch-type pickling plant for handling short bars and awkward shaped small parts which cannot be handled on a continuous type of plant. Each tank is provided with a glandless centrifugal pump which is kept in operation during pickling to ensure rapid circulation of the acid. The acid is heated by live steam injectors. The temperature is maintained constant by a thermostatic steam valve. Lip draughting is provided for each tank and an axial flow fan is used. Fig. 2 shows the plant assembled complete in the manufacturers' works before despatch to site.

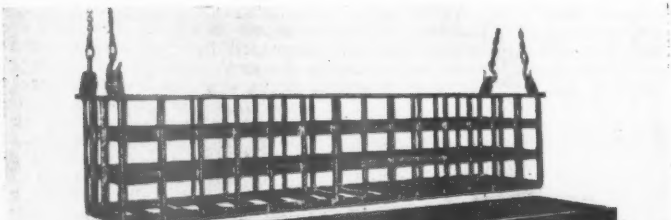
In some firms where a great deal of jobbing work is done, and it is impossible to standardise on any particular shape of steel part, a general-purpose plant is employed. In this case the work is loaded into a large basket and carried by overhead crane into the pickle tanks, wash tank, and neutralising tank. The photograph, Fig. 3, shows an empty basket being lowered into a pickle tank (see page 142).

(*To be continued.*)

NEW CATALOGUE

Foundry Supplies. W. J. Hooker, Limited, of 4, Midland Crescent, London, N.W.3, have just issued a 32-page loose leaf catalogue covering all the day-to-day consumable stores used in the foundry industry, together with quite a few specialised items of plant. In the foreword, there is indicated the existence of a metallurgical service for chemical, physical, and mechanical testing. The arrangement of the contents has been well thought out, and there is no difficulty in ascertaining what lines are covered. If the object of the booklet was to detail the extent of the services covered by the firm's activities within reasonable compass, then it has been very successfully accomplished. It is available to our readers on writing to the firm.

FOUNDRIES in the Falkirk area are to stage a display of their latest products in the Falkirk Victory Day celebration parade on June 8.



THE CHEMISTRY AND MECHANISM OF STEEL PICKLING

FIG. 3.—KESTNER TANK AND CRADLE.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

"FOUNDRY TRADE JOURNAL" IN CHINA

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—In 1943, the British Council inaugurated a scheme for regular supply of British periodicals to China by means of microfilm in order to overcome the isolation of that country brought about by war-time interruption of ordinary communications. With the cordial co-operation of many British publishers this scheme assumed considerable proportions. The microfilms were sent to China by air, and there made available in more than 100 centres by means of a carefully organised loan distribution system.

We have received many communications from Chinese learned bodies and societies appreciative of this effort to keep them in touch with British periodical literature.

With the improvement in communications, the need for this special service disappeared and regular microfilming was brought to an end at the close of 1945. The British Council has now asked me to express its great appreciation of your ready co-operation in a scheme which has proved so well worth while.—Yours, etc.,

B. KENNEDY-COOKE,
Director,
Production Division.

British Council,
3, Hanover Street, London, W.1.
May 24, 1946.

QUEEN MARY, accompanied by Princess Elizabeth, recently visited the research laboratories of the General Electric Company, Limited, at Wembley.

TRAINING WELDERS

Tests for use in the training of welders are the subject of British Standard Specification No. 1295:1946. It has been prepared in an endeavour to unify the general method of assessing the quality of workmanship of a welder during his period of training. It is appreciated that the conditions under which welders are trained in the various schools set up throughout the country naturally vary to a considerable extent. Consequently, there has been a corresponding variation in the methods adopted for assessing workmanship, and the need was felt for test methods which would assist in ensuring that the work of all welding trainees should be judged by similar means, thus leading to a uniform standard of training in all schools. The Standard lays down the general requirements in regard to types of material, preparatory work, simulation to actual work and testing procedure for a series of tests designed to assess the quality of workmanship of a welder during his period of training. Copies of the Standard may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1 (price 3s. 6d. by post).

INDEX TO VOL. LXXVIII

The index to vol. 78 (January to April), is now ready, and is obtainable on application to the Publisher, FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MALLEABLE IRON FACTS—No. 21, the house organ of the [American] Malleable Founders' Society, carries illustrations of castings cast straight and then bent cold to the desired radius, and holes being punched out instead of either coring or drilling.

INCOME TAX AND PAYMENTS TO TECHNICAL COLLEGES

The Inland Revenue Department has decided the allowances which can be made in respect of gifts of money or equipment, or of loans of equipment, made by firms to technical colleges, in determining a firm's liability to income tax, national defence contribution, and excess profits tax.

Gifts for Training

The following decisions have been made:—

(*a*) *Money Contributions towards Current Costs.*—Such contributions may be treated as an expense of the business.

(*b*) *Gifts of Equipment.*—Where the firm replaces the equipment which is the subject of the gift, the difference between the cost of the equipment and the amount already allowed to the firm for taxation purposes in respect of its depreciation is eligible for treatment as an expense of the business for income tax, national defence contribution, and excess profits tax. Where the equipment is not replaced, an allowance of the amount of such difference will be due to the firm for income tax only, and in respect only of a gift made on or after April 6, 1946.

(*c*) *Loans of Equipment.*—If the equipment remains the property of the firm, the usual allowances for depreciation will be given as if the equipment were being used by the firm.

(*d*) *Money Contributions to Capital Costs.*—Authorities will have noted the Chancellor's announcement in his Budget speech that he proposes to grant an income tax allowance in respect of contributions to the capital costs of colleges in certain circumstances. The Finance Bill must be awaited for further particulars of this proposal.

Gifts for Research

Gifts of money and equipment and loans of equipment made by a firm to a technical college for research which is related either to the firm's trade, or to the class of trade to which the firm's trade belongs, may be treated as indicated in (*a*), (*b*) and (*c*) of the preceding paragraph.

In addition, as from April 6, 1946, a contribution to capital cost (including the value of a gift of equipment not covered by the preceding paragraph) is eligible for treatment as an expense of the business in determining the firm's liability to income tax, but not to national defence contribution or excess profits tax, if the college is approved for the purpose of Section 27 of the Finance Act, 1944, by the Committee of the Privy Council for Scientific and Industrial Research, and if the contribution was made on or after April 6, 1944. The colleges listed in the appendix* have been so approved and will be notified accordingly to H.M. Inspector of Taxes. An application from any other college to be added to the list may be made to the

(*Continued at foot of next column.*)

*Included in the list are all the schools and institutes catering for the foundry industry together with the Department of Applied Science of Sheffield University. Generally speaking the universities are not included.

THE FORMATION OF BANDED STRUCTURES IN HORIZONTAL CENTRIFUGAL CASTINGS

(*Continued from page* 137.)

The examination of the literature mentioned indicates that in the cases where banding is associated with columnar crystallisation the castings have been prepared at low speeds. The banding is therefore definitely not Type III banding, and in the writer's view has been produced by the fact that at low speeds the centrifugal force is so small that some of the liquid is not "picked-up" until the latter stages of solidification, and thus forms an entirely fresh layer of crystals.

The enclosure of the correct list of references is appreciated, and it is hoped that suitable corrections can be made. The production of periodic structures in ingots cast on a base subjected to violent shock has not been ignored by the Author, but on the contrary has been carefully considered. It was originally proposed to include the relationship between centrifugal and non-rotative castings in this Paper, but this was omitted to keep the Paper reasonably compact.

Finally the remarks appearing in the Paper under the heading of "Conclusions" must be re-stated. No effort has been made to claim complete finality for the views expressed in the Paper. The Author realises the vast field for experimental research in the field of centrifugal casting, particularly in the study of the flow of liquids in rotating tubes, and the preparation of centrifugal castings under standardised laboratory conditions. Apart from the benefits which may be derived in industrial practice, it is considered that the study of centrifugal casting may throw light on some of the more obscure phenomena encountered in the solidification and feeding of static castings. The Author would be interested in conducting further research on a purely experimental basis, but when the Paper was written he thought that sufficient data had been accumulated from commercial practice for the outline of a theory explaining the formation of banded structures, to be presented.

REFERENCES

[1] L. Northcott and V. Dickin, "The Influence of Centrifugal Casting (Horizontal Axis) Upon the Structure and Properties of Metals," J. Inst. Metals, 1944, Vol. 70, p. 301.

[2] L. Northcott and D. McLean, "The Influence of Centrifugal Casting Upon the Structure and Properties of Steel," J. Iron and Steel Inst., 1945, Vol. 151, p. 303.

[3] L. Northcott and O. R. J. Lee, "The Centrifugal Casting of Aluminium Alloy Wheels in Sand Moulds," J. Inst. Metals, 1945, Vol. 71, p. 93.

[4] O. R. J. Lee, Proceedings Inst. Brit. Foundrymen, 1943-4, Vol. 37, p. A108. Discussion on Paper by J. E. Hurst.

[5] L. Northcott, "Periodic Structures in Metals and Alloys," J. Iron and Steel Inst., 1934, Vol. 129, p. 171.

(*Continued from previous column.*)

Ministry of Education and will be considered on its merits, provided that the college either undertakes or proposes to undertake research work for industry.

If a firm pays fees to a technical college, either for the training of its employees, or for research which is related to the firm's trade, or to the class of trade to which the firm's trade belongs, the payments are eligible for treatment as expenses of the business for income tax, national defence contribution, and excess profits tax.

A NOTE ON THE SOURCES OF HYDROGEN IN CAST IRON

(*Continued from page* 132.)

are in the ratio of their volumes. An estimate of the total hydrogen content of the original molten metal can then be obtained. The gas analysis apparatus could be used to analyse accurately the cupola gases and a "hydrogen" balance for the cupola worked out. The Author, however, has not, as yet, had access to a vacuum fusion or extraction apparatus, but has confined himself to the measurement of the hydrogen evolved during solidification.

Many absurd results were obtained while the aforementioned technique was being evolved, and it is essential that extreme cleanliness and care is used in the preparation of the sample tubes. These can be cleaned and used again until too short to hold over the scoop of metal (18 in.). All leaks in the gas analysis apparatus must be eliminated, and it is essential to buy the best glass vacuum stopcocks for this purpose.

The results detailed in Table I have, however, been obtained and seem to lend colour to the original idea.

TABLE I.—*Coke Moisture Content and Hydrogen Content in Cast Iron.*

Coke Moisture Per cent.	CO_2	O_2	H_2	CO	Remarks.
		Ml. at N.T.P.			
0.5	0.16	0.87	0.44	0.43	Duplicate tubes, same scoop sample.
	0.10	0.60	0.38	0.40	
0.5	0.20	0.34	0.10	0.13	
3.0	0.15	0.67	1.90	0.60	
3.5	0.17	1.03	1.85	0.60	Duplicate tubes.
	0.13	0.73	2.05	0.54	

Time did not permit further confirmation, but the above tests were free from disturbances, leaks, etc., and the agreement in the two duplicate tests is sufficiently close to be satisfactory.

CONCLUSIONS

The results are presented at this stage in order to focus attention as early as possible on this source of hydrogen, and also to draw attention to a possible method for determining the gas content of molten cupola metal in the two stages indicated. Determinations of residual hydrogen on cold samples are not very convincing as they tell only part of the story, and it is the Author's hope that other workers who are already interested in this field will try out the method and extend it to the two-stage determination. It may be that hydrogen is of very minor importance in general foundry practice, but until it is measured, who can tell?

HOUSE FULL!

Since last week's announcement in the JOURNAL concerning the Birmingham Conference of the Institute of British Foundrymen, bookings have been reaching the General Office at a rapid rate. Over 600 bookings are now in hand, making it impossible to accept any further applications.

PARIS TRADE FAIR

The organisers of the Paris Trade Fair, which opened on May 25, and will continue until June 10, claim that it has broken all its previous records with more than 8,000 exhibitors.

There is a small, though comprehensive, light metal section, in which l'Aluminium Francais has an excellent display of castings and stampings, dairy utensils and the like, which is valuable propaganda for aluminium and light alloys.

Gas, electricity and solid-fuel burning appliances figure prominently at the Fair. Most of the stoves are vitreous enamelled and are extremely well made. Inquiries, however, elicited the information that deliveries by French manufacturers, when possible, are permitted to be made only in black metal. Licences to acquire vitreous enamelled stoves are not at present being granted. An enamelled gas stove of modern design and the usual size for a small house is priced at 7,000 francs, or rather less than £15 at the current official rate of exchange. Siemenswerke und Elektro-Heizungstechnik, of Vienna, on the other hand, are exhibiting gas and electric stoves and water heaters which, we were told, can be delivered in full, vitreous enamel finish. The Syndicat General des Fondeurs de France have an excellent display of a wide range of precision castings.

ECONOMIC BUREAU FOR PALESTINE

The "Economic Bureau for Palestine," which represents the official organisations of Palestinian industry, trade and finance in this country, has been established in London to facilitate and develop economic and financial relations between the United Kingdom and Palestine. The Bureau will provide up-to-date economic information on Palestine and will function as a liaison office and information centre for both Palestinian organisations and official and semi-official bodies in the United Kingdom. The Bureau will gratefully receive all information on economic conditions in this country for transmission to Palestine. Mr. Martin Lederman has been appointed Director of the Bureau, and has taken up residence at 12, Buckingham Palace Mansions, Buckingham Palace Road, London, S.W.1. 'Phone, Sloane 1000.

ANOTHER FILM STRIP

The Bulletin of the Council of Ironfoundry Associations announces that a new film strip, "Making Cast Iron Crankshafts," will shortly become available. The cost is 5s. in black and white, and 25s. in colour. The earlier film strip, "The Future for Boys in the Foundry," is now also available in colour at 15s. Its popularity is steadily increasing. T. H. & J. Daniels, Limited, of Lightpill Iron Works, Stroud, Glos., possess a modern film strip projector, which they are willing to lend to firms and institutions located reasonably near to Stroud.

PERSONAL

SQUADRON-LEADER COADE, D.F.C., has been appointed blast-furnace manager at the Redcar Ironworks of Dorman, Long & Company, Limited.

SIR AMOS L. AYRE, Director of Merchant Shipbuilding, 1939-44, has received the honorary degree of D.Sc. from Durham University in recognition of his war service.

MR. J. F. BOOTH, managing director of Hepworth Iron Company, Limited, Hazlehead, Sheffield, has been appointed a Justice of the Peace for the West Riding of Yorkshire.

CAPT. R. C. PETTER has resigned from the position of managing director of British Oil Engines (Export), Limited, but will remain on the board and act in an advisory capacity.

MR. F. V. WRIGHT, A.M.I.Mech.E., has set up in practice as a consulting and inspecting engineer and also for the preparation of designs, plant layouts and plans, at 137A, Hill Top, West Bromwich.

MR. R. HINCHCLIFFE, naval architect to Vickers-Armstrongs, Limited, 1926-41, and temporary lecturer at King's College, Newcastle-upon-Tyne, 1942-45, has received the honorary degree of M.Sc. from Durham University.

MR. THOMAS HAROLD HILL, who has been made president-elect of Wolverhampton Rotary Club, is a director of Thomas H. Hill & Sons, Limited, sheet-metal workers, etc., and joint managing director of Thos. Hills Motor Fittings Company, Limited.

MR. ALEXANDER BOYES, formerly technical assistant to the superintendent of foundries and patternshops at Metropolitan-Vickers Electrical Company, Limited, Trafford Park, Manchester, has been appointed foundry manager to James Smethurst & Son, iron and brass founders, of Warrington.

DR. R. GENDERS has recently relinquished the post of Superintendent, Technical Applications of Metals, Ministry of Supply, in order to take up private practice as a consultant on materials and research. He has been retained as metallurgical adviser by the Ministry. His address is Green Ridges, The Meadow, Chislehurst, Kent.

MR. JOHN FRY, who 34 years ago founded Fry's Metal Foundries, Limited, which, following its association in 1925 with the Eyre Smelting Company, Limited, of Merton Abbey, London, S.W.19, has developed into a group of companies, was recently presented by his staff and workpeople with his portrait in oils to mark the occasion of his 70th birthday.

MR. F. B. GEORGE has been appointed works development manager of the Consett Iron Company, Limited. His duties will be to build up, supervise and control a special development department which has been set up. MR. H. V. TOMLINSON, who has become works production manager, will be responsible for the works administration, operation and control.

SOUTH DURHAM STEEL & IRON COMPANY

OPPOSITION TO B.I.S.F. PLAN

Presiding at the annual meeting of South Durham Steel & Iron Company, Limited, Mr. Benjamin Talbot, chairman, revealed that the company and its subsidiary, Cargo Fleet Iron Company, Limited, are engaged in the complete electrification of all their driving units, involving an estimated expenditure of £700,000. This project, when completed, he said, would effect a substantial reduction in the consumption of coal and the cost of production. They were also carrying out essential reconstruction of their West Hartlepool plate mill, which the report of the British Iron and Steel Federation proposed should be completely discarded.

"We have continuously opposed the Federation proposals as affecting our works," said Mr. Talbot. These proposals, he added, would ultimately reduce the West Hartlepool works to an inefficient re-rolling light-plate production with the abandonment of five steel furnaces, one heavy plate mill, and one medium-plate mill, with three blast furnaces, one of which was a new furnace only blown in within the last few weeks. "We decline," he said, "to be a willing party to depriving shipbuilders in our immediate vicinity of plate supplies of a capacity which they cannot obtain elsewhere on the North-East Coast." They were prepared to discuss with other North-East Coast producers the Federation proposals for the Cargo Fleet works for the installation of a continuous billet mill, but they could not proceed with further schemes while the present uncertainty prevailed.

OBITUARY

MR. FRANCIS GEORGE HARLOW, managing director of Robert Harlow & Son, Limited, brassfounders, etc., of Stockport, has died suddenly.

SIR WILLIAM ISHERWOOD, Bt., managing director of Sir Joseph W. Isherwood & Company, Limited, ship construction engineers, died last week at the age of 48.

MR. ERIC MARTIN SMEETH, a partner in the firm of Thos. S. Smeeth, iron, steel and coke merchants, of Bradford, died on May 24 at his home at Burley-in-Wharfedale. He was 49.

MR. B. C. ELLERTON, managing director of Ben Wright & Company, Limited, manufacturers of boiler non-conducting composition, boiler coverers, etc., of Middlesbrough, has died at the age of 62.

MR. THOMAS HENRY WILLCOX, who died on May 23, was a director of W. H. Willcox & Company, Limited, manufacturers of engineers' stores, pump, hose and belting makers, etc., of Southwark Street, London, S.E.1. He was 65.

MR. WILLIAM MORRISON, managing director of William Morrison & Sons (Leith), Limited, mechanical engineers, paper-machinery and wire-cloth manufacturers, died recently in his 95th year. He had regularly attended to business until about a fortnight before his death.

NEWS IN BRIEF

CENSURE OF UNOFFICIAL STRIKERS and a plea to all workers in the Ironfounding Workers' Association to give every effort to the industrial transition from war to peace production is contained in the annual report of the Association.

A MEETING OF EXPERTS on colour and lighting in industry held recently at the offices of the Industrial Welfare Society, decided to form a Co-ordinating Committee on Colour and Lighting in Industry under the auspices of the British Colour Council.

JOHN G. KINCAID & COMPANY, LIMITED, Greenock, builders of the Burmeister & Wain-Harland & Wolff Diesel engine, have acquired a licence from the Aktiebolaget Atlas Diesel, Stockholm, to build the Atlas Polar engine of the "M.T." type—to be known as Kincaid-Polar engine.

MR. J. RAMSAY GEBBIE, managing director of Wm. Doxford & Sons, Limited, engineers and shipbuilders, Pallion, said that shipbuilding was being delayed through inability to get supplies even if shipbuilders were prepared to pay the big increases in costs. Costs were rising daily, he added.

THE FIFTIETH ANNIVERSARY of the British Thomson-Houston Company, Limited, was celebrated last month, the company having been formed on May 18, 1896, from an organisation which had developed from the original London firm of Laing, Wharton & Down, which started trading in 1886.

AT AN EXTRA-ORDINARY GENERAL MEETING of the Renold & Coventry Chain Company, Limited, held recently, a resolution was passed converting the 279,608 6 per cent. cumulative preference £1 shares into 6 per cent. cumulative preference stock, and the 905,048 ordinary £1 shares into ordinary stock.

THE DIRECTORS of Range Boilers, Limited, propose to raise additional capital by the issue of 40,000 ordinary shares of 5s. each at a price of 17s. per share to holders of ordinary shares in the proportion of one new ordinary share for every seven now held. Permission to deal in the new shares has been granted.

IMPORTS INTO THE River Tyne during the first quarter of this year included 7,285 tons of iron and steel manufactures and scrap, compared with 6,479 tons last year, 9,264 (11,524) tons of metals and minerals (excluding iron ore), and 55,886 (67,956) tons of iron ore. Exports during the quarter included 15,972 tons of iron and steel manufactures.

BERSHAM FOUNDRY, WREXHAM, one of the oldest foundries in North Wales, is being modernised, and when reconstruction is completed, employment will be found for 100 men. During the war the foundry has been producing on a small scale only. Production of machine-tool castings for agricultural purposes is expected to begin in July.

A. C. WICKMAN, LIMITED, of Coventry, announce that they will shortly deliver their "Wimet" tipped small tools with a protective plastic coating, covering the tungsten carbide, for prevention of damage to the cutting edges during transport and subsequent storage by the user. The coating is easily removable without affecting the tool and can be re-used.

THE ASSOCIATION OF BRONZE AND BRASS FOUNDERS intimate that the following informal meetings have been arranged:—June 19, Midland Area, at the Queen's Hotel, Birmingham, at 12.45 p.m.; June 24, Lancashire and Cheshire Area, at the Midland Hotel, Manchester, at 2.30 p.m.; July 1, Yorkshire Area, at the Great Northern Hotel, Leeds, at 12.45 p.m.

THE INSTITUTE OF PHYSICS announces that its newly formed Industrial Spectroscopic Group will hold its first conference on July 5 and 6 in the auditorium of the Wellcome Research Foundation, 183, Euston Road, London, N.W.1. The conference will review the present status of industrial spectroscopy and will be open to all interested without charge, whether members of the Institute or not.

THE ACTIVITIES of the Development Section of Ford Motor Company, Limited, at Dagenham—a department for examining employees' suggestions and ideas—have undoubtedly effected increased economy and efficiency, states a circular on the subject issued by the firm. Results, it states, have proved in this connection the inestimable value of the closest co-operation between the management and the employees.

AT THE ANNUAL GENERAL MEETING of the Institute of Physics held on May 29, the following were elected to take office on October 1 next:—President, Prof. A. M. Tyndall; vice-presidents, Prof. J. A. Crowther, Dr. H. Lowery and Mr. A. J. Philpot; hon. treasurer, Mr. E. R. Davies; hon. secretary, Dr. B. P. Dudding; new ordinary members of the board, Dr. A. McCance, Mr. W. S. Vernon, Dr. F. A. Vick. Dr. G. F. C. Searle, F.R.S., was elected an Honorary Fellow of the Institute.

PROPOSING THE TOAST "The Engineering Industry" at the anniversary festival of the London Association of Engineers, on May 24, Sir A. H. Roy Fedden said the word "engineer" in English covered a wide field—from the mechanic to the managing director of a large firm or a director of research. In spite of this, the engineer did not hold as high a status in this country as he did abroad. Sir Roy felt it was important that the engineers of this country should see that their successors were so equipped mentally that this complex was dissipated, as at present it tended to clog their effort to rise to the higher grades of their profession.

NEWS COMES FROM South Africa of an amalgamation of two well-known firms:—Wright, Boag & Company, Limited, and Head, Wrightson (Pty.), Limited. The new company is to be known as Wright, Boag & Head Wrightson (Pty.), Limited, and the directors are to be Mr. John Mackenzie (chairman), Sir Guy Wrightson (deputy chairman) and Mr. P. M. Boag; Mr. H. Wright and Mr. N. Mackay (from Wright, Boag), Major Miles and Mr. J. J. Walker, with Mr. R. W. Burnard and Mr. N. Rutherford as alternates. Mr. Walker is to be managing director. The old Johannesburg shops of Wright, Boag are to be closed and new ones erected at Benoni, adjacent to those the Head, Wrightson concern.

THE MODERN PIG

IF YOU WANT...

clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify

STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3¾ inches

(at notch 2½ inches).

Made in our well-known

STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

COMPANY RESULTS

(Figures for previous year in brackets.)

Park Gate Iron & Steel—Dividend of 8% (same).

Harris & Sheldon—Interim dividend of 2½% (same).

Harrison (Birmingham)—Dividend of 20%, tax free (same).

Arthur Lee & Sons—Interim dividend of 15% (same).

Yorkshire Amalgamated Products—Dividend of 5% (same).

Crompton Parkinson—Interim dividend of 7½% (same).

Howard & Bullough (Securities)—Dividend of 5% (same).

Albion Drop Forgings—Interim dividend of 5% (same).

Armstrong, Stevens & Son—Dividend of 20% (17½%).

Newall Engineering—Final dividend of 20%, making 30% (same).

G. Hopkins & Sons—Net profit for 1945, £30,782 (£30,407); dividend of 17½% (same); forward, £17,515 (£16,278).

Scammell Lorries—Net profit for 1945, £26,111 (£24,025); dividend of 8½% (same); forward, £25,369 (£16,797).

Ransomes & Rapier—Net profit for 1945, £30,661 (£29,603); dividend of 6%, tax free (same); forward, £3,349 (£2,031).

British Electric Resistance—Net profit to July 31, £8,809 (£5,694); dividend of 20% (same); forward, £8,211 (£4,402).

Platt Bros. & Company (Holdings)—Profit for the year ended March 31, £100,565 (£98,057); to reserve, £12,000 (nil); dividend of 10% (same); forward, £19,682 (£19,439).

W. T. Henley's Telegraph Works—Net profit for 1945, after tax, £337,894 (£347,852); final dividend of 10% and bonus of 5%, making 20% (same); forward, £393,220 (£399,326).

Peglers—Profit for the year ended March 31, after making provision for E.P.T., £116,388 (£99,241); to general reserve, £25,000 (£20,000); dividend of 30% (26¼%) and bonus of 10% (nil); forward, £21,745 (£17,822).

Babcock & Wilcox—Trading profit for 1945 and dividends from subsidiary and associated companies, less bad debts and expenses, £904,108 (£938,271); provision for U.K. income-tax, £374,153 (£395,530); provision for deferred repairs, £100,000 (£62,000); special dividends (net) from subsidiary companies paid out of profits of previous years, £172,940 (nil); provision for E.P.T. for previous year not required, £33,879 (£28,776); dividend of 6%, making 10% (same), and bonus of 2½% (2%); to general reserve, £175,000 (nil); forward, £147,159 (£137,380).

NUMBER OF FURNACES IN BLAST ON MARCH 30, 1946, AND WEEKLY AVERAGES FOR PREVIOUS SIX QUARTERS

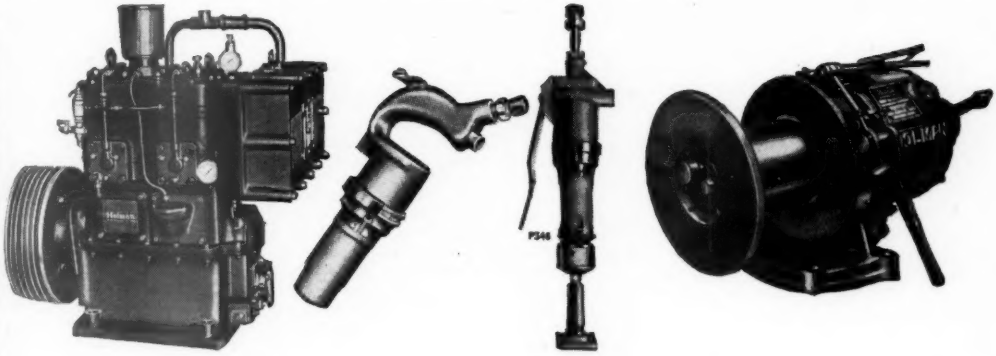
(Particulars supplied by the courtesy of the British Iron and Steel Federation)

District.	Weekly average in blast March quarter.	Total in blast on March 30.	Total in blast on March 30 making				Total built.	Furnaces relining.	Weekly average number of furnaces in blast for previous six quarters.					
			Hematite.	Forge and foundry.	Basic.	Ferro-alloys, etc.			Dec., 1945.	Sept., 1945.	June, 1945.	Mar., 1945.	Dec., 1944.	Sept. 1944.
Scotland	10	10	1	5	4	—	22	1	10	10	10	10	8.6	9
Durham & Northumb.	4	4	1	—	3	—	11	—	4	4	4	4	4	4
Cleveland	21	21	4	—	15	2	34	7	21	20.6	21.2	22	22	22
Northants	7	7	—	1	6	—	14	2	7	7	5.8	7	7.2	8
Lincolnshire ..	12.4	12	—	—	12	—	19	2	13.4	13.3	13.3	14.1	13.4	13.9
Derbyshire ..	10.6	10	—	9	1	—	15	4	10.2	11.8	13	13	13	11.8
Notts & Leics.	3	3	—	3	—	—	5	1	3	3	3	3	3	3
S. Staffs. & Worcs.* ..	4.5	4	—	2	2	—	9	—	4.9	3.8	4	3.3	3.9	4.9
N. Staffordshire	3	3	—	—	2	1	5	1	3	2.7	3	3	3	3
W. Cumberland	4	4	4	—	—	—	8	2	4	4	4	4	4	4
Lancashire	6	6	2	—	2	2	14	1	6	5.2	5.5	6	6	5.3
S. Wales & Mon. ..	7	7	1	—	6	—	10	1	6.9	6.7	6.9	6.9	7	7
S. & W. Yorkshire ..	2	2	—	—	2	—	2	—	2	1.1	1	1.7	2	2
Shropshire	1	1	—	1	—	—	3	1	1	1	1	1	0.1	—
N. Wales	2	2	—	—	1	1	3	1	2	2	2	1.6	1	0.6
Essex	1	1	—	1	—	—	1	—	1	1	1	1	0.9	—
Totals ..	98.5	97	13	22	56	6	175	24	99.4	97.2	98.7	101.6	99.1	98.5
Totals for previous qtr.	99.4	99	11	23	58	7								

The following new furnaces are building: South Durham, 1 (Durham and Northumberland); Round Oak, 1 (South Staffs and Worcestershire).

* One furnace on cold-blast pig-iron.

AIR can do the job
Holman make the Plant



COMPRESSORS
Displacements from 80 cubic ft./min. to 638 cubic ft./min.

HAMMERS
Weights from 7¼ lbs to 13¾ lbs.

Holman Bros. have pioneered Pneumatic Plant for many industries and those which they serve include: Metal Mines of every kind, Coal Mines, Quarries, Dockyards, Foundries, Contractors, Railways—throughout the world.

RAMMERS
Weights from 9 lbs. to 40 lbs.

AIRWINCHES
Lifting capacities from 1,400 lbs at 100 ft./min. to 3,000 lbs. at 100 ft./min.

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Raw Material Markets

IRON AND STEEL

Pig-iron deliveries to the foundries are covering immediate needs, but stocks are low both at the furnances and at consuming points, particularly of high-phosphorus iron. The light-castings foundries continue to be very busy, especially in connection with the requirements of housing programmes, which may be expected to be on a heavy scale over a very long period. Activity among the engineering foundries, too, is considerable and is steadily expanding. Substantial quantities of low- and medium-phosphorus irons, together with hematite and refined pig-iron, are being absorbed.

The scrap position is fairly satisfactory on the whole, but certain grades—light and medium cast-iron scrap, for example—are in short supply. Ferro-alloys present no difficulty, while adequate supplies of limestone and ganister are forthcoming. The long-term outlook of foundry coke is not at all reassuring. Current deliveries are sufficient for immediate needs, but there is little or no opportunity for consumers to accumulate stocks, which they usually do at this time of the year.

Best bars are in good request from the heavy trades and some improvement from the shipbuilding yards has been apparent recently, while substantial support is being received from the chain makers. The works catering for No. 3 and No. 4 iron have plenty of business on hand, but more support is needed for crown bars and strip. Many of the works are now rolling down steel billets, as well as iron, which enables them to keep their plants in full production.

The re-rollers are anxious about supplies of billets because of the recent drop in the volume of imported supplies, and it is understood that there is no immediate prospect of supplies from abroad being augmented. The output from home sources is nothing like sufficient to meet the needs of the re-rollers when they are fully engaged. There appears to be sufficient sheet bars to keep the sheet mills fully employed. Makers of billets have no accumulations of defectives or crops, and they have ready outlets for supplies of these as they accrue from current rollings.

Steelworks manufacturing commercial grades for the shipyards, structural engineers, etc., are full up with specifications, particularly so in plates. All sizes of angles, channels and joists are in brisk request and emphasis at the moment is on light sections. Due to the expansion of the home trade very little will be available for export, although it is understood that there are considerable quantities on hand for shipment abroad against business accepted some time ago.

NON-FERROUS METALS

Increased ceiling prices of copper and lead have been announced by the U.S. Office of Price Administration. The copper price has been raised by 2¾ cents per lb. to 14¾ cents, while the price of lead has been advanced by 1¾ cents per lb. for primary metal at New York, with similar increases in other base point prices, thus raising the price from 6½ cents to 8¼ cents per lb. The revised quotations took effect on Monday. In the case of copper, the increase applies only to metal received from mines which have granted the approved wage increases since February 14. The only major producer in that position so far is the Anaconda concern. Shortage of copper is causing many manufacturers to close down.

Production has been interrupted at a number of copper mines in Northern Rhodesia, due to shortage of coal supplies. It was expected that operations would be resumed within a few days when stocks had again been built up to a safe figure.

EMPLOYEES of the Worsley Mesnes Ironworks, Limited, Wigan, enjoyed a visit to Blackpool and Pilling recently as guests of the directors.

IN A MEMORANDUM issued to members of the National Union of Manufacturers, strong opposition is expressed to the Government's plan to nationalise the iron and steel industry.

TREASURY SANCTION is being sought for an issue to ordinary stockholders of Ransomes, Sims & Jefferies, Limited, engineers and ironfounders, of Ipswich, of 250,000 ordinary shares.

THE MECHANICAL ENGINEERING DEPARTMENT of Birmingham University is to be rehoused, together with the electrical engineering department, in an adequately equipped modern building, at a cost of £250,000.

HEAD, WRIGHTSON & COMPANY, LIMITED, of Thornaby-on-Tees, have formed a new subsidiary, the Head, Wrightson Machine Company, Limited, and have acquired the site of the old marine engineering works of Richardsons, Westgarth & Company, Limited, at Middlesbrough for the large-scale production of steelworks equipment. Operations have commenced and substantial orders have been received from Sweden.

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